Metadata for the Stockton Fish and Wildlife Office's San Francisco Bay/San Joaquin Delta Juvenile Fish Monitoring Program

December, 2008

Name of study: IEP Delta Juvenile Fish Monitoring Program

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Purpose/Objective: The original objective of the San Francisco Bay/San Joaquin Delta Juvenile Fish Monitoring Program in the 1970's and 1980's was to monitor effects of water projects in the Delta on abundance, distribution and survival of juvenile fall run Chinook salmon in the lower Sacramento and San Joaquin Rivers, Delta and San Francisco Bay. This objective was broadened in the 1990's to include relative abundance and distribution of all races of juvenile Chinook salmon. In 2001, the program changed its name from the Juvenile Salmon Program in the Delta to the Delta Juvenile Fish Monitoring Program to reflect expanded objectives in monitoring juvenile fish in the Delta. Species information at times has been recorded for jellyfish and crustaceans spp. that are encountered.

General category of data collected: Native and exotic species of fish found within the San Francisco Bay/Sacramento-San Joaquin Delta and lower Sacramento and San Joaquin Rivers.

Geographic range of current field work: There are currently fifty-eight (58) beach seine sites located on the Lower Sacramento River, San Joaquin River, North, Central and South Delta and San Francisco Bay (Table 2; Figure 1). Three (3) boat trawling stations are also regularly sampled (Table 3; Figure 1). These are located at Sherwood Harbor on the Sacramento River, Chipps Island in Suisun Bay and Mossdale Crossing County Park on the San Joaquin River. In addition, special studies have been conducted throughout the years (i.e., Liberty Island, Delta Cross Channel, VAMP, etc).

Each sampling site is designated by a Station Code which displays the abbreviations of the body of water sampled (Table 1), the number of miles from the mouth of the river or bay, and which side of the body of water was sampled (e.g., site AM001S is 1 mile from the mouth of the American River on the south bank).

Figure 1. Current Sampling Sites

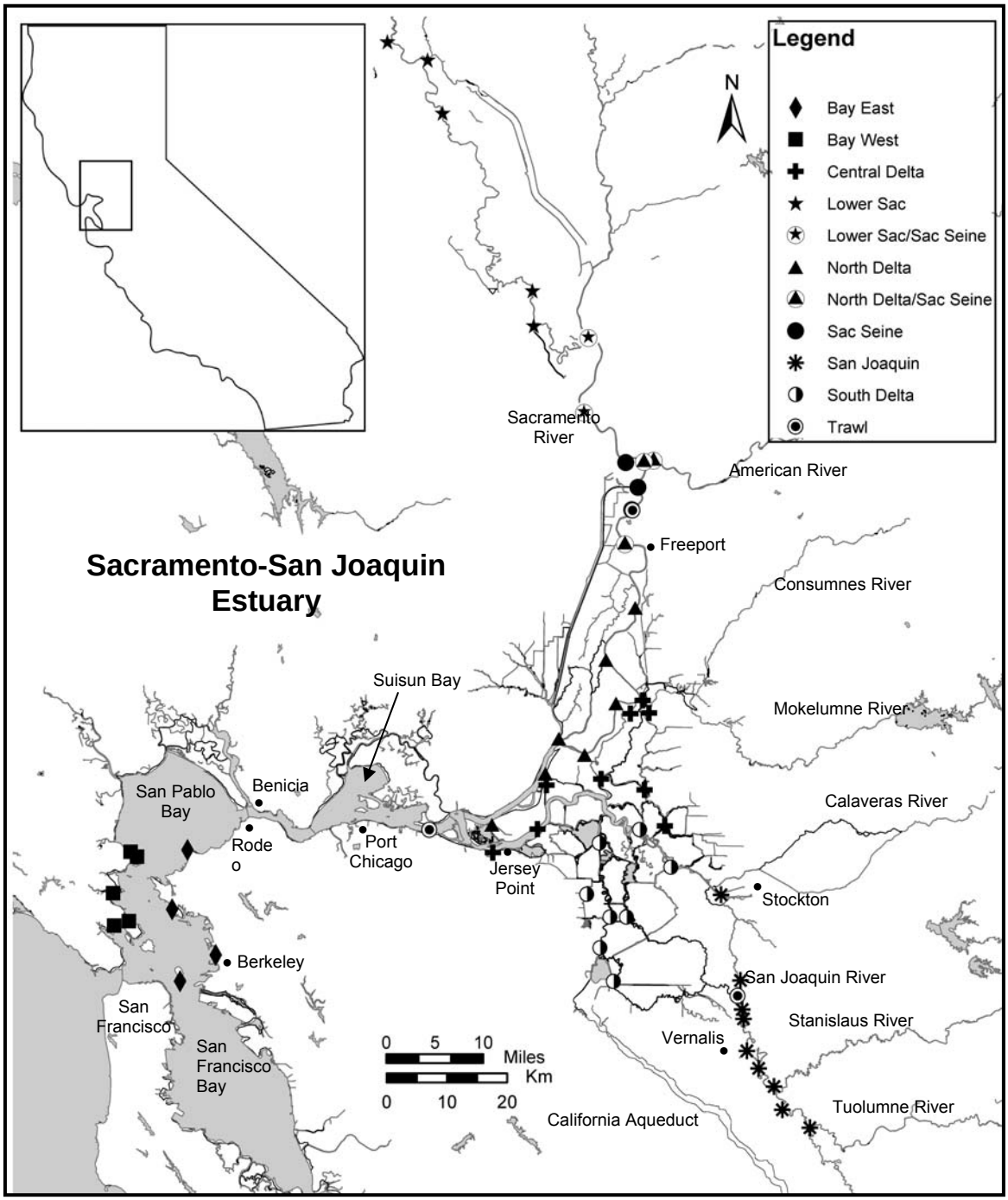

Table 1. Abbreviations of sampling sites.

Name of the body of water	Abbreviations
American River	AM
Big Break	BB
Clifton Court Forebay	CC
Columbia Cut	CL
Calaveras River	CR
Carquinez Straight	CS
Disappointment Slough	DS
Fabian Bell Canal	FC
False River	FR
Georgiana Slough	GS
Holland Cut	HC
Little Potato Slough	LP
North Fork Mokelumne River	MK
Middle River	MR
3 Mile Slough	MS
Montezuma Slough	MZ
Old River	OR
Petaluma River	PR
Richardson Bay	RB
Roaring River	RR
Rock Slough	RS
San Francisco Bay	SA
Suisun Bay	SB
South Fork Mokelumne River	SF
San Joaquin River	SJ
San Pablo Bay	SP
Sacramento River	SR
Steamboat Slough	SS
Turner Cut	TC
Tuolumne River	TM
Victoria Canal	VC
Werner Dredger Cut	WD
Whiskey Slough	WS
Delta Cross Channel	XC

Table 2. Current beach seining locations (2008). Location data are from UTM Zone 10.

Station Code	Site Name	Seine Routes	Region	Northing	Easting
SR144W	Colusa St. Park	Lower Sacramento	1	4341656	585025
SR138E	Wards Landing	Lower Sacramento	1	4338872	591788
SR130E	South Meridian	Lower Sacramento	1	4329679	594637
SR094E	Reels Beach	Lower Sacramento	1	4301257	610604
SR090W	Knights Landing	Lower Sacramento	1	4295501	610842
SR080E	Verona	Lower Sac. & Sac.	1	4293731	620040
SR071E	Elkhorn	Lower Sac. & Sac.	1	4281347	619622
SR062E	Sand Cove	Sacramento	1	4273305	626877
SR057E	Miller Park	Sacramento	2	4268976	629278
SR055E	Sherwood Harbor	Sacramento	2	4265348	628183
SR060E	Discovery Park	N. Delta & Sac.	2	4273510	629832
AM001S	American River	N. Delta & Sac.	2	4273377	630116
SR049E	Garcia Bend	N. Delta & Sac.	2	4259864	627053

SR043W	Clarksburg	North Delta	2	4249355	629172
SS011N	Steamboat Slough	North Delta	2	4240590	624599
SR024E	Koket	North Delta	2	4233484	626481
SR017E	Isleton	North Delta	2	4224777	621633
SR014W	Rio Vista	North Delta	2	4227356	617123
SR012E	Stump Beach	North Delta	2	4221376	615130
MS001N	Sherman Island	North Delta	2	4212729	606510
XC001N	Delta Cross Channel	Central Delta	3	4234103	630923
GS010E	Georgiana Slough	Central Delta	3	4231902	628924
SF014E	Wimpy's	Central Delta	3	4232064	632060
DS002S	King Island	Central Delta	3	4213448	635241
LP003E	Terminous	Central Delta	3	4219072	631486
MK004W	B&W Marina	Central Delta	3	4220914	624413
TM001N	Brannan Island	Central Delta	3	4219582	615380
SJ005N	Eddo's	Central Delta	3	4212250	614105
SJ001S	Antioch Dunes	Central Delta	3	4208154	606836
SJ032S	Lost Isle	South Delta	4	4206630	636369
SJ026S	Medford Island	South Delta	4	4212580	630722
OR003W	Franks Tract	South Delta	4	4210310	624451
WD002W	Veale Tract	South Delta	4	4201793	622614
OR014W	Cruiser Haven	South Delta	4	4198100	626919
OR023E	Union Island	South Delta	4	4187470	627520
MR010W	Woodward Island	South Delta	4	4198143	629321
OR019E	Old River 1	South Delta	4	4193018	625145
SJ041N	Dad's Point	South Delta	4	4202179	645276
SJ051E	Dos Reis	South Delta	4	4188369	648599
SJ056E	Mossdale	San Joaquin	5	4183537	649045
SJ058W	Weatherbee	San Joaquin	5	4181967	649362
SJ058E	Weatherbee E (Alt.)	San Joaquin	5	4181796	649579
SJ063W	Big Beach	San Joaquin	5	4176674	650048
SJ065W	Critchett Rd.	San Joaquin	5	4175464	651896
SJ068W	Durham Site	San Joaquin	5	4173593	652316
SJ070N	Durham Ferry	San Joaquin	5	4172602	653315
SJ074W	Sturgeon Bend	San Joaquin	5	4170887	654784
SJ076W	North of Route 132	San Joaquin	5	4168461	656485
SJ077E	Route 132	San Joaquin	5	4167216	656413
SJ079E	San Luis Refuge	San Joaquin	5	4166732	658066
SJ083W	North of Tuol. River	San Joaquin	5	4164348	661220
SA010W	San Quentin	Bay West	6	4199450	545475
SA004W	Tiburon	Bay West	6	4194324	544827
SA008W	Paradise Beach	Bay West	6	4194207	547678
SP001W	China Camp	Bay West	6	4205986	547332
SP000W	McNear's Beach	Bay West	6	4205115	548092
SA001M	Treasure Island	Bay East	6	4185320	555450
SA007E	Berkeley Frontage	Bay East	6	4189618	561558
SA009E	Keller Beach	Bay East	6	4197177	553896
SP003E	Point Pinole E.	Bay East	6	4206949	556120

Table 3. Current boat trawling stations (2008), Location data are from UTM Zone 10.

Station Code	Site Name	Northing	Easting
SB018X	Chipps Island	4211218	595531
SR055M	Sherwood Harbor	4265965	628707
SJ054M	Mossdale Crossing	4185588	648278

If Latitude and Longitude are provided how were they determined? Either hand held (Garmin, GPSmap76) or mounted (Furuno, GPS185OD) GPS receivers are used to determine northing or easting coordinates. The coordinates are recorded as Zone 10 UTM (Universal Transverse Mercator) beginning in 1995.

Period of record (start year): The Stockton Fish and Wildlife Office (STFWO) started sampling in 1976. In the 1990's, the range and scope of the study were broadened and are similar to those presently conducted. The number and location of the sites sampled and the methods have changed slightly over the years (see Tables 4, 5 and 6).

Sample frequency per time unit (week, month, etc): The number of days that a given trawl location or seine site is sampled has varied by location and by season (see Table 4 for the current year (2006), Table 5 for historical trawls and Table 6 for historical seines).

Currently, the Sherwood Harbor Trawl samples the Sacramento River three days per week between October 1st and March 31st using a Kodiak trawl (see methods). During the months of April, July, August and September Sherwood Harbor is sampled three days per week with a mid-water trawl. During the months of May and June the site is sampled twice per week with a mid-water trawl. The Mossdale Crossing Trawl site on the San Joaquin River is sampled three days per week year round with a Kodiak trawl. However, during the months of April, May and June the sampling is typically conducted by CDFG Region 4 and data are reported by STFWO. The Chipps Island Trawl site in Suisun Bay is sampled three days per week year round, except during May and June, and sometimes April, when it is sampled daily and at times two shifts per day for a total of 20 tows per day. During December and January, Chipps Island is sampled 7 days per week with ten 20 minute trawls conducted daily. This additional sampling is conducted to recover marked juvenile salmon released in the Delta and upstream. Sample times are recorded as military time and observe daylight savings time.

Table 4. Current sampling methods (2008) and frequency of samples per week.

Sampling Method	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sherwood Harbor mid-water trawl	0	0	0	3	2	2	3	3	3	0	0	0
Sherwood Harbor Kodiak trawl	3	3	3	0	0	0	0	0	0	3	3	3
Chipps Island mid-water trawl	7	3	3	7	7	7	3	3	3	3	3	7
Mossdale Crossing Kodiak trawl	3	3	3	3	3	3	3	3	3	3	3	3
Sacramento Seine	1	0	0	0	0	0	0	0	0	3	3	3
Lower Sacramento Seine	1	1	1	1	1	1	1	1	1	1	1	1
North Delta Seine	1	1	1	1	1	1	1	1	1	1	1	1
Central Delta Seine	1	1	1	1	1	1	1	1	1	1	1	1
South Delta Seine	1	1	1	1	1	1	1	1	1	1	1	1
San Joaquin Seine	1	1	1	1	1	1	1	1	1	1	1	1
West and East Bay Seines	1	1	1	1	1	1	1	1	1	1	1	1

Table 5. Trawl locations (Historical) and dates sampled, mid-water and Kodiak trawls.

Year	Location/Station	Method	Tows/ Day	Min./ Tow	Days/ Wk	Dates
1976	Clarksburg/SR043*	MWTR	2-18	8-15	0-5	05/13/76- 07/09/76
1976	Chipps Is./SB018*	MWTR	5-13	17-20	0-6	05/18/76- 07/09/76, 10/18/76- 11/16/76
1977	Clarksburg/SR043*	MWTR	7-28	7-19	0-7	05/09/77- 07/08/77
1977	Chipps Is./SB018*	MWTR	6-12	19-20	1-7	05/09/77- 06/28/77
1978	Clarksburg/SR043*	MWTR	7-12	8-10	0-6	06/05/78- 06/15/78
1978	Chipps Is./SB018*	MWTR	7-12	19-20	0-7	04/03/78- 06/26/78
1979	Clarksburg/SR043*	MWTR	10	10	0-5	06/04/79- 06/14/79
1979	Chipps Is./SB018*	MWTR	3-10	19-20	0-7	04/02/79- 07/12/79
1980	Clarksburg/SR043*	MWTR	10	10	0-7	06/02/80- 06/25/80
1980	Chipps Is./SB018*	MWTR	1-10	15-20	0-7	01/14/80- 06/30/80, 10/01/80- 12/30/80
1981	Clarksburg/SR043*	MWTR	9-10	10	0-6	06/01/81- 06/17/81
1981	Chipps Is./SB018*	MWTR	3-10	18-20	0-7	04/06/81- 07/02/81
1982	Chipps Is./SB018*	MWTR	2-10	20	0-6	04/06/82- 06/24/82
1983	Chipps Is./SB018*	MWTR	1-10	13-20	1-7	04/08/83- 07/01/83
1984	Chipps Is./SB018*	MWTR	2-10	18-20	0-7	04/02/84- 07/03/84
1985	Chipps Is./SB018*	MWTR	2-10	15-20	0-7	04/01/85- 06/20/85
1986	Chipps Is./SB018*	MWTR	8-10	20	2-7	04/07/86- 06/18/86
1987	Chipps Is./SB018*	MWTR	8-10	19-25	0-7	04/06/87- 06/22/87
1988	Chipps Is./SB018*	MWTR	3-21	18-20	2-7	04/05/88- 07/08/88
1988	Sherwood Hbr./SR055*	MWTR	5-10	6-20	2-5	04/05/88- 06/28/88
1989	Chipps Is./SB018*	MWTR	6-10	19-20	1-7	04/05/89- 06/30/89
1989	Sherwood Hbr./SR055*	MWTR	5-10	14-20	0-5	04/14/89- 06/28/89
1990	Chipps Is./SB018*	MWTR	3-10	17-20	1-7	04/05/90- 06/22/90
1990	Courtland/SR035*	MWTR	3-12	10	0-5	02/02/90- 03/22/90, 04/11/90- 06/20/90
1990	Hood/SR036*	MWTR	5-12	10	0-2	02/02/90- 03/22/90
1990	Hood/SR037*	MWTR	6-9	10	0-2	02/02/90- 03/22/90
1990	Hood/SR038*	MWTR	3-12	10	0-2	02/02/90- 03/22/90
1991	Chipps Is./SB018*	MWTR	8-10	19-20	1-7	04/02/90- 06/28/90
1991	Sherwood Hbr./SR055*	MWTR	2-12	10-20	0-3	04/15/91- 06/12/91, 12/05/91- 12/30/91
1992	Chipps Is./SB018*	MWTR	3-10	18-20	0-7	04/03/92- 06/26/92
1992	Sherwood Hbr./SR055*	MWTR	4-12	10-20	0-7	01/02- 03/25, 05/06- 06/12, 09/08-12/31
1992	Mayberry Slough/MS020*	MWTR	10	20	0-5	04/20/92- 05/01/92
1992	Sac. River/SR027*	PUSH	4-9	10-15	0-1	12/04/92- 12/10/92
1992	Walnut Grove/SR026*	PUSH	6-8	10-13	0-1	12/04/92- 12/15/92
1992	Verona/SR080*	PUSH	3	10	0-1	11/10/92
1992	Sac. River/SR059*	PUSH	3	10	0-1	11/17/92
1992	Sac. River/SR034*	PUSH	2-9	10-20	0-1	11/20/92, 12/04/92
1992	Georgiana Sl./GS009*	PUSH	5	10	0-1	12/15/92
1992	Georgiana Sl./GS004*	PUSH	4	10	0-1	12/15/92
1992	Sac. River 1/SR131*	PUSH	1	10	0-1	11/03/92
1992	Sac. River 2/SR132*	PUSH	2	10	0-1	11/03/92
1992	Sac. River 3/SR134*	PUSH	3	10	0-1	11/03/92
1992	Sac. River 4/SR137*	PUSH	4	10	0-1	11/03/92
1992	Wards Landing/SR138*	PUSH	5	10	0-1	11/03/92
1992	Sac. River/SR028*	PUSH	9-10	20	0-1	12/01/92
1992	Sac. River/SR090*	PUSH	1	10	0-1	11/20/92
1992	San Joaquin River/SJ019*	PUSH	1	10	0-1	12/18/92
1992	Mokelumne River/MK001*	PUSH	1-5	10	0-1	12/18/92- 12/29/92
1992	Mokelumne River/MK002*	PUSH	1-10	10	0-2	12/18/92- 12/31/92

1992	Mokelumne River/MK003*	PUSH	4-10	10	0-1	12/18/92- 12/29/92
1992	Delta X-Channel/XC001*	PUSH	3-4	10	0-1	12/01/92- 12/10/92
1992	Georgiana Sl./GS001*	PUSH	5-7	8-10	0-1	12/10/92- 12/29/92
1993	Chipps Is./SB018*	MWTR	7-10	10-20	1-7	04/05/93- 07/08/93, 11/01/93- 12/30/93
1993	Sherwood Hbr./SR055*	MWTR	4-11	10-20	0-5	01/04/93- 06/23/93, 09/27/93- 12/30/93
1993	Georgiana Sl./GS004*	PUSH	8	10	0-1	01/19/93
1993	Old River 5/OR015*	PUSH	2-10	20	1-3	02/09/93- 03/29/93
1993	Old River 4/OR018*	PUSH	10	21	0-1	03/30/93
1993	Montezuma Sl./MZ020*	MWTR	5-11	20	0-5	05/12/93- 05/25/93
1993	Montezuma Sl./MZ021*	MWTR	5-10	20	0-5	05/12/93- 05/25/93
1993	Sac. River/SR047*	MWTR	6	20	0-1	06/09/93
1993	Sac. River/SR048*	MWTR	7	20	0-1	06/09/93
1993	Sac. River/SR050*	MWTR	3	20	0-1	06/09/93
1993	Sac. River/SR053*	MWTR	2	20	0-1	06/09/93
1993	Mokelumne River/MK001*	PUSH	1-4	10	0-2	01/12/93- 01/19/93
1993	Mokelumne River/MK002*	PUSH	1-10	10	0-2	01/05/93- 01/19/93
1993	Mokelumne River/MK003*	PUSH	1-10	10	0-2	01/05/93- 01/19/93
1993	Mokelumne River/MK003*	MWTR	1-10	10-20	0-1	01/07/93- 01/11/93
1993	Georgiana Sl./GS001*	PUSH	4-10	20	0-3	01/21/93- 02/04/93, 04/02/93- 04/12/93
1993	Georgiana Sl./GS001*	MWTR	5-10	18-20	0-4	01/13/93- 04/01/93
1994	Chipps Is./SB018*	MWTR	5-10	19-20	1-7	01/03/94- 06/20/94, 10/03/94- 12/31/94
1994	Sherwood Hbr./SR055*	MWTR	1-10	10-20	0-5	01/03/94- 06/17/94, 09/26/94- 12/28/94
1994	Sherwood Hbr./SR055*	KDTR	7-10	20	0-2	12/22/94- 12/30/94
1994	Mossdale/SJ054*	KDTR	1-10	10	0-5	04/22/94- 06/08/94
1994	Mayberry Slough/MS020*	MWTR	1-13	20	0-5	04/25/94- 05/06/94
1994	Mokelumne River/MK001*	MWTR	1-10	10-20	0-3	01/07/94- 02/16/94
1994	Mayberry Slough/MS021*	MWTR	5-15	20	0-5	04/26/94- 05/06/94
1994	Rock Slough/RS001*	PUSH	1-10	20	0-3	02/18/94- 06/03/94
1995	Chipps Is./SB018*	MWTR	1-10	16-20	0-7	01/03/95- 12/28/95
1995	Sherwood Hbr./SR055*	MWTR	4-26	18-20	0-7	03/16/95- 10/23/95
1995	Sherwood Hbr./SR055*	KDTR	1-10	10-20	0-7	01/03- 03/07, 04/06- 04/27, 10/20- 12/31
1995	Bacon Island/MR009*	KDTR	5-10	19-20	0-7	05/01/95- 06/29/95
1995	Fay Island/OR009*	KDTR	5-10	19-20	0-7	05/01/95- 06/29/95
1995	Jersey Point/SJ011*	MWTR	6-10	20	0-7	05/01/95- 05/21/95
1995	Head Old River/OR046*	KDTR	1-8	20	0-7	05/12/95- 05/20/95
1995	Dos Reis/SJ051*	KDTR	6-10	16-20	0-6	05/12/95- 05/20/95
1995	Webb Tract/OR001*	KDTR	1-10	20	0-7	05/02/95- 06/30/95
1996	Chipps Is./SB018*	MWTR	1-10	18-20	0-7	01/03/96- 08/19/96, 10/09/96- 12/30/96
1996	Sherwood Hbr./SR055*	MWTR	2-10	17-20	0-7	04/01/96- 10/03/96
1996	Sherwood Hbr./SR055*	KDTR	4-10	20	0-7	01/02/96- 04/04/96, 10/04/96- 12/31/96
1996	Mossdale/SJ054*	KDTR	1-13	10-20	0-7	04/01/96- 06/28/96, 09/04/96- 12/27/96
1996	Bacon Island/MR009*	KDTR	1-10	17-20	0-4	05/07/96- 06/29/96
1996	Fay Island/OR009*	KDTR	5-11	20	0-4	05/07/96- 06/29/96
1996	Jersey Point/SJ011*	MWTR	5-11	18-20	0-7	04/01/96- 06/30/96
1996	Head Old River/OR046*	KDTR	5-12	14-20	0-7	04/01/96- 05/06/96
1996	False River/FR002*	KDTR	5-11	20	0-7	04/04/96- 06/30/96
1996	Turner Cut/TC002*	KDTR	4-19	16-20	0-7	04/01/96- 06/30/96
1996	Walnut Grove/SR026*	KDTR	9-27	10	0-4	04/01/96- 06/27/96
1996	Dos Reis/SJ051*	KDTR	1-10	20	0-7	04/01/96- 05/06/96
1996	Webb Tract/OR001*	KDTR	1-10	5-25	0-7	04/05/96- 06/30/96
1996	Columbia Cut/CL000*	KDTR	5-11	13-20	0-7	04/01/96- 06/30/96
1996	Georgiana Sl./GS001*	KDTR	6-27	10	0-4	04/01/96- 06/27/96
1997	Chipps Is./SB018*	MWTR	2-10	18-20	0-7	01/03/97- 12/31/97

1997	Sherwood Hbr./SR055*	MWTR	5-10	18-20	0-5	01/24/97- 02/14/97, 03/31/97- 10/16/97
1997	Sherwood Hbr./SR055*	KDTR	2-10	17-20	0-5	01/21, 02/18- 03/25, 10/17- 12/23
1997	Mossdale/SJ054*	KDTR	9-21	10	1-7	03/21/97- 06/27/97
1997	Jersey Point/SJ011*	KDTR	1-10	20	0-5	04/03/97- 06/26/97
1997	Head Old River/OR046*	KDTR	2-5	19-20	0-4	04/03/97- 04/12/97
1997	False River/FR002*	KDTR	4-11	17-20	0-5	04/17/97- 06/26/97
1997	Turner Cut/TC002*	KDTR	2-10	18-20	0-5	04/03/97- 06/28/97
1997	Webb Tract/OR001*	KDTR	1-10	5-20	0-5	03/31/97- 06/28/97
1997	Columbia Cut/CL000*	KDTR	5-11	18-20	0-5	04/03/97- 06/28/97
1998	Chipps Is./SB018*	MWTR	1-20	10-20	0-7	01/03/98- 06/29/98, 09/02/98- 12/31/98
1998	Sherwood Hbr./SR055*	MWTR	5-11	18-20	0-3	03/30/98- 06/29/98, 12/01/98- 12/04/98
1998	Sherwood Hbr./SR055*	KDTR	1-10	18-20	0-5	01/02/98- 03/27/98, 09/03/98- 12/28/98
1998	Mossdale/SJ054*	KDTR	3-10	10-21	0-5	04/02/98- 06/30/98, 11/04/98- 12/28/98
1998	Bacon Island/MR009*	KDTR	10	20	0-2	04/20/98- 04/21/98
1998	Fay Island/OR009*	KDTR	10	20	0-5	05/11/98- 05/18/98
1998	Jersey Point/SJ011*	KDTR	2-10	18-20	0-5	04/03/98- 06/30/98
1998	Head Old River/OR046*	KDTR	5	20	0-2	04/17/98- 04/18/98
1998	False River/FR002*	KDTR	5-11	15-20	0-5	04/04/98- 06/30/98
1998	Turner Cut/TC002*	KDTR	5	18-20	0-6	04/02/98- 06/30/98
1998	Webb Tract/OR001*	KDTR	1-10	20	0-5	04/02/98- 06/30/98
1998	Columbia Cut/CL000*	KDTR	6-10	19-20	0-5	04/02/98- 06/30/98
1999	Chipps Is./SB018*	MWTR	1-21	13-20	0-7	01/01/99- 12/31/99
1999	Sherwood Hbr./SR055*	MWTR	2-13	14-20	0-5	03/26/99- 10/01/99
1999	Sherwood Hbr./SR055*	KDTR	4-10	20	0-5	01/04/99- 03/26/99, 10/05/99-12/30/99
1999	Mossdale/SJ054*	KDTR	2-11	19-20	0-5	01/06/99- 06/29/99, 10/18/99- 12/29/99
1999	Bacon Island/MR009*	KDTR	2-10	10-20	0-5	04/02/99- 07/02/99
1999	Turner Cut/TC002*	KDTR	1-4	20	0-5	04/01/99- 07/02/99
1999	Webb Tract/OR001*	KDTR	1-10	14-20	0-5	04/01/99- 06/24/99
1999	Quimby East/OR004*	KDTR	3-9	12-22	0-5	04/01/99- 06/24/99
1999	Palm Tract/OR008*	KDTR	1-8	20-30	0-5	04/01/99- 06/29/99
1999	Prisoners Point/SJ024*	KDTR	1-10	19-20	0-5	04/01/99- 06/24/99
1999	Little Mandeville/HC002*	KDTR	1-8	20-30	0-5	04/01/99- 06/29/99
1999	San Joaquin River/SJ031*	KDTR	3-5	10-20	0-5	04/01/99- 07/02/99
1999	Connection Slough/CS001*	KDTR	7-8	13-20	0-5	04/01/99- 07/02/99
1999	Columbia Cut/CL000*	KDTR	5-7	10-20	0-5	04/01/99- 07/02/99
2000	Chipps Is./SB018*	MWTR	3-20	18-20	0-7	01/02/00- 12/27/00
2000	Sherwood Hbr./SR055*	MWTR	7-20	20	0-3	03/29/00- 09/28/00
2000	Sherwood Hbr./SR055*	KDTR	3-10	14-20	0-5	01/03/00- 03/27/00, 10/04/00-12/30/00
2000	Mossdale/SJ054*	KDTR	1-20	10-20	0-5	01/03/00- 06/30/00
2000	Sac. River/SR027*	MWTR	15-166	14-17	0-3	11/13/00- 11/22/00
2000	Delta X-Channel/XC001*	MWTR	16-90	14-19	0-3	11/13/00- 11/22/00
2001	Chipps Is./SB018*	MWTR	1-20	17-20	0-7	01/03/01- 12/31/01
2001	Sherwood Hbr./SR055*	MWTR	5-10	19-20	0-3	03/28/01- 07/16/01, 08/06/01- 09/28/01
2001	Sherwood Hbr./SR055*	KDTR	5-10	18-20	0-4	01/02/01- 03/26/01, 10/01/01-12/28/01
2001	Mossdale/SJ054*	KDTR	3-20	18-20	0-7	02/13/01- 09/10/01
2001	Sac. River/SR027*	MWTR	40-69	14	0-2	10/29/01- 11/02/01
2001	Benicia/SB001*	MWTR	5-10	17-20	0-6	01/20/01- 01/29/01
2001	Benicia/CS008*	MWTR	6-10	18-20	0-6	01/21/01- 02/16/01
2001	Antioch Dunes/SJ001*	KDTRX	5	19-20	0-1	05/01/01- 05/08/01
2001	Delta X-Channel/XC001*	MWTR	39-68	15	0-2	10/29/01- 11/02/01
2002	Chipps Is./SB018*	MWTR	10	20	0-7	01/02/02- 12/31/02
2002	Sherwood Hbr./SR055*	MWTR	2-10	19-20	0-3	03/28/02- 09/26/02
2002	Sherwood Hbr./SR055*	KDTR	4-51	17-20	1-4	01/02/02- 03/26/02, 09/30/02- 12/30/02

2002	Mossdale/SJ054*	KDTR	6-15	18-20	0-7	01/07- 01/18, 02/27- 07/17, 12/11- 12/30
2003	Chipps Is./SB018*	MWTR	1-61	18-20	0-7	01/02/03- 12/31/03
2003	Sherwood Hbr./SR055*	MWTR	3-48	18-20	0-3	04/02/03- 09/29/03
2003	Sherwood Hbr./SR055*	KDTR	2-51	20-21	0-4	01/03/03- 03/31/03, 10/01/03- 12/31/03
2003	Mossdale/SJ054*	KDTR	3-15	19-20	0-7	01/15/03- 12/31/03
2004	Chipps Is./SB018*	MWTR	2-20	18-20	0-7	01/02/04- 12/31/04
2004	Sherwood Hbr./SR055*	MWTR	6-10	12-20	0-3	02/18/04- 03/12/04, 04/05/04- 09/29/04
2004	Sherwood Hbr./SR055*	KDTR	6-42	18-20	0-4	01/02- 02/17, 03/15- 03/31, 10/01- 12/30
2004	Mossdale/SJ054*	KDTR	2-15	18-20	0-7	01/02/04- 12/30/04
2005	Chipps Is./SB018*	MWTR	8-20	19-20	0-7	01/02/05- 12/30/05
2005	Sherwood Hbr./SR055*	MWTR	9-55	19-20	0-4	04/01/05- 09/30/05
2005	Sherwood Hbr./SR055*	KDTR	9-10	19-20	0-3	01/03/05- 03/30/05, 10/03/05- 12/30/05
2005	Mossdale/SJ054*	KDTR	10-15	19-21	0-7	01/03/05- 12/30/05
2006	Chipps Is./SB018*	MWTR	10-20	20	3	01/02/06- 12/31/06
2006	Sherwood Hbr./SR055*	MWTR	10	20	2-3	04/03/06- 09/29/06
2006	Sherwood Hbr./SR055*	KDTR	10	20	3	01/06/06- 03/31/06, 10/02/06- 12/29/06
2006	Mossdale/SJ054*	KDTR	10	20	3	01/04/06- 12/29/06
2007	Chipps Is./SB018*	MWTR	10-13	5-20	3	01/02/07- 12/31/07
2007	Sherwood Hbr./SR055*	MWTR	10	20	2-3	04/02/07- 09/29/07
2007	Sherwood Hbr./SR055*	KDTR	10	20	3	01/02/07- 03/30/07, 10/01/07- 12/31/07
2007	Mossdale/SJ054*	KDTR	10	20	3	01/03/07- 12/31/07
2008	Chipps Is./SB018*	MWTR	13	5-20	3	01/02/08- 02/04/08, 03/10/08- 12/17/08
2008	Benicia/SB001*	MWTR	10	20	3	02/08/08- 03/08/08
2008	Sherwood Hbr./SR055*	MWTR	10	20	2-3	04/02/08- 09/29/08
2008	Sherwood Hbr./SR055*	KDTR	10	20	3	01/02/08- 03/31/08, 10/01/08- 12/17/08
2008	Mossdale/SJ054*	KDTR	10	20	3	01/02/08- 12/17/08

* Indicates that channel location or compass bearings are not specified.

Table 6. Seine sites (Historical) and dates sampled

Station Code	Site Name	Region	First Sampled	Last Sampled
SR144W	Colusa St. Park	1	03/24/81	Current
SR138E	Wards Landing	1	02/18/81	Current
SR130E	South Meridian	1	05/19/81	Current
SR094E	Reels Beach	1	02/18/81	Current
SR090W	Knights Landing	1	02/18/81	Current
SR080E	Verona	1	02/18/81	Current
SR071E	Elkhorn	1	02/18/81	Current
SR062E	Sand Cove	1	09/30/94	Current
SR130X	Ox Bow	1	04/22/81	04/22/81
SR184E	Ord Bend	1	02/18/81, 09/01/92	06/23/82, 11/12/97
SR258E	Bend Bridge	1	02/19/81	06/23/82
SR298W	Posse Grounds	1	02/19/81, 03/24/84	06/23/82, 03/24/84
SR284W	Anderson	1	02/19/81	06/23/82
SR119E	Tisdale Weir	1	02/18/81	03/24/81
SR185W	Glen Gravel Bar	1	02/18/81	03/24/81
SR163W	Princeton	1	02/18/81, 09/01/92	06/23/82, 12/09/97
SR276E	Balls Ferry	1	02/19/81	06/23/82
SR244E	Lake Red Bluff	1	02/19/81	04/23/82
SR243E	RBDD	1	02/19/81, 05/24/03	06/23/82, 05/24/03
SR218E	Woodson Bridge	1	02/19/81	05/24/82
SR252W	Iron Canyon	1	12/09/92	12/09/92
SR193E	Bidwell	1	09/01/92	09/09/92
SR057E	Miller Park	2	09/21/94	Current

SR055E	Sherwood Harbor	2	09/28/94	Current
SR060E	Discovery Park	2	12/07/76	Current
AM001S	American River	2	05/28/76	Current
SR049E	Garcia Bend	2	03/08/76	Current
SR043W	Clarksburg	2	03/08/76	Current
SS011N	Steamboat Slough	2	03/08/76, 11/18/92	06/21/78, Current
SR024E	Koket	2	03/09/76	Current
SR017E	Isleton	2	03/09/76	Current
SR014W	Rio Vista	2	03/09/76	Current
SR012E	Stump Beach	2	03/09/76	Current
MS001N	Sherman Island	2	03/24/76	Current
SS005W	Steamboat Slough	2	03/09/76	03/29/78
SR014E	Cliff House	2	06/15/76	06/15/76
XC001N	Delta Cross Channel	3	03/09/76	Current
GS010E	Georgiana Slough	3	03/09/76	Current
SF014E	Wimpy's	3	10/26/76	Current
DS002S	King Island	3	02/07/79	Current
LP003E	Terminous	3	10/26/76, 02/07/79	11/03/76, Current
MK004W	B&W Marina	3	02/07/79	Current
TM001N	Brannan Island	3	03/09/76	Current
SJ005N	Eddo's	3	03/16/76	Current
SJ001S	Antioch Dunes	3	02/06/79	Current
SB019S	Pittsburg Bridge	3	03/26/76	02/06/79
BB001S	Big Break	3	05/04/77	05/04/77
RR001N	Roaring River	3	01/30/80	05/20/81
CR005S	Calaveras River	3	12/02/93	01/14/99
MZ023E	Montezuma Slough 1	3	01/30/80	06/24/80
MZ022W	Montezuma Slough 2	3	01/30/80	06/24/80
MZ021W	Montezuma Slough 4	3	01/30/80	06/24/80
SJ032S	Lost Isle	4	11/23/93	Current
SJ026S	Medford Island	4	01/24/02	Current
OR003W	Franks Tract	4	11/23/93	Current
WD002W	Veale Tract	4	11/23/93	Current
OR014W	Cruiser Haven	4	11/23/93	Current
OR023E	Union Island	4	06/06/97	Current
OR001M	Webb Tract	4	03/16/76, 04/21/97	06/11/76, 04/21/97
MR010W	Woodward Island	4	02/07/79	Current
SJ041N	Dad's Point	4	02/07/79	Current
SJ051E	Dos Reis	4	03/30/94	Current
OR019E	Old River 1	4	12/05/93	Current
FC006X	Fabian Bell Canal	4	03/12/76	05/15/78
OR001X	Old River (mouth)	4	03/16/76, 04/21/97	06/11/76, 04/21/97
OR022W	Federal Fish Facility	4	03/26/76	06/09/76
OR018W	Old River 4	4	03/26/76, 11/16/92	04/11/86, 01/27/94
SJ026N	Venice Island	4	02/07/79	09/02/03
TC002E	Turner Cut	4	01/28/93	08/31/95
WS001E	Whiskey Slough	4	03/17/93	11/12/93
VC002N	Victoria Canal	4	11/12/93	11/05/96
OR017E	Old River 3	4	11/23/93	01/06/94
OR018E	Old River 4	4	01/17/87	05/15/92
SJ056E	Mossdale	5	03/30/94	Current
SJ058W	Weatherbee	5	03/30/94	Current
SJ058E	Weatherbee E (Alt.)	5	02/22/95	Current

SJ063W	Big Beach	5	03/30/94	Current
SJ065W	Critchett Rd.	5	06/19/08	Current
SJ068W	Durham Site	5	03/30/94	Current
SJ070N	Durham Ferry	5	08/12/08	Current
SJ074A	Sturgeon Bend Alt	5	06/19/08	Current
SJ074W	Sturgeon Bend	5	03/30/94	Current
SJ076W	North of Route 132	5	06/19/08	Current
SJ077E	Route 132	5	03/30/94	Current
SJ079E	San Luis Refuge	5	08/12/08	Current
SJ083W	North of Tuol. River	5	03/30/94	Current
SJ087W	Grayson	5	12/21/00	05/03/04
SJ063E	Big Beach E	5	06/24/97, 05/12/04	06/24/97, 05/12/04
SA010W	San Quentin	6	02/04/80, 01/29/97	02/04/80, Current
SA004W	Tiburon	6	02/04/97	Current
SA008W	Paradise Beach	6	03/11/76, 02/04/80, 01/29/97	05/20/76, 04/16/82, Current
SP001W	China Camp	6	01/29/97	Current
SP000W	McNear's Beach	6	03/11/76, 02/04/80, 01/29/97	05/20/76, 03/18/82, Current
SA001M	Treasure Island	6	03/10/76, 01/30/80	05/20/76, 04/16/82, Current
SA007E	Berkeley Frontage	6	03/10/76, 02/04/80, 01/28/97	5/20/76, 03/18/82, Current
SP000E	Point Molate	6	02/04/80, 02/18/98	02/18/82, 07/11/03
SA009E	Keller Beach	6	02/04/80, 02/05/98	02/04/80, Current
SP003E	Point Pinole E.	6	01/30/80, 02/05/98	04/16/82, Current
SP003W	Point Pinole W.	6	02/03/81	05/12/81
SB000X	Martinez Bridge	6	01/30/80	01/30/80
SP008E	Rodeo	6	03/10/76, 01/30/80	06/09/76, 01/30/80
SP004E	Wilson Point	6	03/10/76	05/20/76
SB010X	Middleground Island	6	03/16/76	06/11/76
CS006S	Brickyard Beach	6	03/25/76, 05/15/78, 01/30/80	06/09/76, 05/15/78, 04/16/82
SB009S	Port Chicago	6	02/06/79	03/14/79
CS003S	Port Costa	6	02/06/79	02/06/79
CS001S	Crockett	6	01/30/80	04/16/82
PR001W	Petaluma River Br.	6	02/04/80, 02/25/98	04/16/82, 02/25/98
SA008E	Point Richmond Jetty	6	02/04/80	02/04/80
SP001E	Pt. San Pablo Harbor	6	02/04/80	02/04/80
RB003X	Richardson Bay	6	02/04/80	02/04/80
SA003S	S.F. Municipal Pier	6	02/04/80	02/04/80
SA010W	San Quentin Beach	6	02/04/80, 01/29/97	02/04/80, Current
SA003W	Sausalito Harbor	6	02/04/80	02/04/80

San Pablo and San Francisco Bay seine sites are presently sampled once every two weeks year round. The San Joaquin River seine sites are sampled weekly from January to June, then every two weeks from July to December. However, the upstream sites, Weatherbee, Big Beach, Durham Site, Sturgeon Bend, Route 132, North of Tuolumne River and Grayson are frequently not accessible from July 1st to December 31st due to low water levels in the river (Grayson was only sampled from 2001-2004). Currently, the South, Central and North Delta seine sites are sampled weekly year round. South and Central Delta were only sampled every other week during the summer months in some years due to funding limitations. The Lower Sacramento seine sites are sampled once per week from January 1st to December 31st. The Sacramento seine sites are sampled three days per week from October 1st to January 31st. The Sacramento seine route generally

combines some of the sites from the Lower Sacramento seine route and some of the sites from the North Delta seine route, plus three seine sites that are only sampled from October through January (Sand Cove, Sherwood Harbor and Miller Park).

Comments about study (e.g. idiosyncrasies, changes over time, special events, etc.): Modifications are made regularly to accommodate safety conditions and/or special studies. Of the 58 beach seine sites sampled, three of the sites on the Sacramento seine routes are only sampled between October and January (see comments above). Six of the beach seine sites on the San Joaquin River are only sampled when there is sufficient water depth for these sites to be accessible by boat (see comments above). All other sites are sampled year round if weather and physical site condition permits. Beach seine sites are evaluated regularly for access and suitability, and, since 1993, if the original seine site was compromised or was not suitable, an alternative site adjacent (within 50 m) to the original may have been selected.

Before August 1, 1977 all Chinook salmon captured were measured and fork lengths recorded. Between August 1, 1977 and July 31, 1992 only 50 Chinook salmon from each sample taken were measured and those not measure were recorded as a total sum, minus those measured. After August 1, 1992 fifty individuals from each race of Chinook salmon were measured and those not measured were assigned a count reference number to associate them with measured Chinook salmon. All Chinook salmon from all years are entered into our database as CHN. The salmon race (run) is a calculated designation and is not recorded. Our database program uses a length at date captured criteria to calculate the salmon race (see appendix). Fish that are not measured are designated with a fork length of "0" and a count of "1" or greater. Chinook salmon that were not measured between August 1, 1977 and July 31, 1992 are not able to be raced nor are they able to be associated with any measured fish.

Boat trawls are usually conducted in the upstream direction in the center of the river, with the exception of Chipps Island, which is conducted traveling either upstream or downstream on the north, center or south sides of the channel.

Since July1995, fish species collected shorter than 25 mm FL are considered to be too small to be accurately identified in the field and as such are not identified or measured. Exceptions to this are: Rainwater killifish, Sacramento sucker, Mosquito fish, Sacramento splittail and Three-spine sticklebacks which are considered identifiable in the field down to 20 mm FL.

Table 7. Idiosyncrasies, changes over time and special events

Changes in Procedure	**Date**	**Reason**
Juvenile salmon monitoring program started	1976	To monitor impact of water projects on juvenile salmon
Mid-water trawls conducted at Clarksburg	1976-1981	Recovery of marked fish released upstream
Gear Condition Codes 5, 6 and 7 used for some samples	1976-1992	To indicate: non-target species caught, or numbers were estimated, or 100-150 ft. seine nets were used.
No start or end values recorded for flow meters, only total meter entered into database	1976-1986	Transcription efficiency
Beach seining moved from beaches to boat ramps on	1978	Many of the beaches previously sampled were rip-rapped

Lower Sacramento River		
Reassigned beach seining sites upstream of Colusa to Red Bluff office	1982	Travel times to and from sample sites were unreasonable.
Net dimensions and flow meter values started being recorded for catch per cubic meter calculations	1985	To determine volume of water sampled
Mid-water trawls conducted at Courtland and Hood	1990	* See notes below
Program's objective broadened to include all races of juvenile salmon	1992	Obtain information on all races of juvenile salmon
Tow net used at Sherwood Harbor	1991-1992	Index abundance of fry entering the delta
Push-net used on Sacramento & Mokelumne Rivers, Georgiana & Rock Sloughs	1992-1994	Alternative sampling methods evaluated
Salmon identified by race, determined by size criteria	1992	Estimate abundance of each race
Numbers of a salmon race in excess of 50 are plus counted	1993	Sampling efficiency
Beach seining conducted on a year round basis	1993	To obtain information on all races of juvenile salmon
Kodiak trawls routinely conducted at Sherwood Harbor	1994	Greater chance of capturing larger, less abundant races of salmon
Beach seining was expanded to include San Joaquin River and South Delta	1994	Greater coverage of spatial area for juvenile salmon
Size restriction on measuring fish <25 mm FL	07/09/1995	Difficult to identify larval fish in field accurately
15 minute rule formalized on all disturbed areas prior to sampling	1996	To negate influences of recreational users and boat traffic on sampling results
Temperatures recorded in °C instead of °F	1996	To be consistent with scientific literature
Beach seines reinitiated in San Francisco and San Pablo Bays	1997	Greater spatial coverage for juvenile salmon
New net with a bigger mesh (1/8" changed to 5/16") used on Chipps trawl	10/06/1997	To reduce capture of juvenile and larval Delta smelt
Adult salmon and steelhead counted, but not measured. Documented as >500 mm & >300 mm, respectively.	1998	Reduces handling stress
Fish not identified by species recorded as unidentified species	2000	Makes the database more consistent and less ambiguous
Program name changed to the Delta Juvenile Fish Monitoring Program	2001	To reflect broadened objectives and catch of multiple species
New seine nets ordered and 15 m measuring tape attached to nets	2004	To ensure accurate measurement of sampling area. Previous nets were found to be short 1-2 meters.
Gear Condition Code 4's are entered into database	08/01/2006	To provide electronic documentation of when sites are not sampled
Small gauge wires used to secure flow meters	10/06/2006	To reduce turbulence and improve flow meter accuracy

* Sampling conducted at Hood in February, March for winter run salmon to compare results with earlier study conducted at same location by Ray Shaffter (CDFG) in 1973.

* Sampling conducted near "Courtland" to determine how juvenile salmon were horizontally distributed across the channel just upstream of the Delta Cross Channel.

Field Sampling

Gear type or field instrument used:

Beach Seines

- A 50 ft. x 4 ft. (15.2 m x 1.3 m) seine net with 35 lb. Delta 1/8 inch (0.3 cm) square mesh and a 4 ft. x 4 ft. (1.3 m x 1.3 m) bag. Each net has a float line and lead line attached to 6 ft. (1.8 m) wooden poles at each end.
- An YSI Model 30 electro-conductivity meter for recording conductivity and temperature. Became part of the program's standard operating procedure in 1999.
- A darkened bottle containing MS-222 in solution and two shallow 2 gal. (7.6 l) tubs for the anesthetizing and recovery of fish. Became part of the program's standard operating procedure in 2005.
- A sub-sampling kit composed of graduated containers of different sizes (4 liter, 700 ml and 600 ml) with 2 mm holes in the bottoms to allow drainage. Became part of the program's standard operating procedure in 2005.
- A Celsius thermometer (analog)

Nets and gear used while seining are numbered and are uniquely identified and specifically used for individual routes to help prevent the spread of invasive species as part of our Hazard Analysis Critical Control Point Program (HACCP). This became part of the program's standard operating procedure in 2005.

Trawling

- Secchi disc
- Calibrated Flow meter, General Oceanics Inc., Model # 2030R.
- The mid-water trawl net used at Sacramento is composed of six panels, each decreasing in mesh size towards the cod end. Fully extended mouth size is 6 ft. x 15 ft. (1.8 m x 4.6 m) dry measurement and mesh size range from 8 inch (20.3 cm) stretch at the mouth to ½ inch (1.3 cm) stretch just before the cod end. The cod end is composed of 1/8 inch (0.3 cm) weave mesh. Doors made of ¼ inch (0.6 cm) stainless steel (one on each side of the bottom of the net) are attached to the net with shackles and connected to bridles with chain and then Miller Swivels. Hydrofoils with floats spread the top of the net at water level and are attached using the same equipment as the depressors. One hundred foot long ¼ inch (0.6 cm) diameter Amsteel rope bridles are attached to Miller Swivels and attached to the cables from the boat. The net is fished 100 ft. (30.5 m) from the boat (swivels are located just aft of the A-frame). Actual fishing dimensions of the net vary due to currents and weather conditions and have been described in past reports (1992 Annual Report, Sacramento/San Joaquin Estuary Fishery Resource Office, U. S. Fish and Wildlife Service, Stockton, California, 1993, pp. 23-27).
- The larger mid-water trawl net used at Chipps Island is similar in construction to the mid-water trawl net used at Sacramento and has a mouth dimension of 10 ft. x 30 ft. (3 m x 9 m) dry measurement. Six panels, each decreasing in mesh size towards the cod end. Mesh sizes ranged from 4 inch to ½ inch (10 cm to 1.3 cm) stretch just before the cod end. Cod end is composed of 5/16 inch (0.8 cm) knotless material. Depressors and hydrofoils were connected in the same manner

as with the smaller Sacramento mid-water trawl. The net is fished 150 ft. (45.7 m) aft of the vessel.

- Kodiak trawl nets are used at Sacramento and Mossdale. They have variable mesh with fully expandable mouth openings of 6 ft. x 25 ft. (1.8 m x 7.6 m) dry measurement.
- Although called mid-water trawling, the trawls for all sampling are towed at the surface.

The estimated fishing net mouth area, extrapolated from mid-water trawl studies (United States Fish and Wildlife Service, 1993), is 12.5 m^2 for the Kodiak trawl. A float line and lead line attached to spreader bars enable the net to fish the top 1.8 m of the water column. The Kodiak trawl is fished with an aluminum live box as a cod end to avoid excessive fish mortality. Two boats tow the Kodiak net through the water, one pulling each wing. At the end of each tow, field crew on one of the boats retrieve the live box from the end of the net and remove the fish. To help prevent the spread of invasive species as part of our Hazard Analysis Critical Control Point Program (HACCP) trawl net and sampling gear are dedicated to specific sampling areas and sampling sites are visited in order from upstream to downstream.

Beach Seining

For on-shore sampling, a 50' (15.2 m) beach seining net is used. One person holds one end of the net on shore while the other person wades out to either the length of the net, a maximum 1.2 m depth or to where a break or obstruction occurs on the slope. The depth and distance out from shore is recorded in meters, which are pre-marked on each net. The person on shore brings the other end of the net out and the first person then stretches the net across parallel to the shore until either the full 15 m are deployed or an obstruction is reached. If the distance is less than 15 m the net is pulled taut and the measurement (in m) is recorded. The net is then pulled in towards the shore using the attached 6 ft (1.8 m) wooden poles, keeping the lead line on the bottom. Average depth (calculated from the two ends of the net), width, and length of the net are also recorded.

Trawling

On mid-water boat trawls, the cod end of the net is tied with a quick release knot and thrown overboard when the boat operator has given the signal to toss. The Amsteel lines on the hydraulic spools are let out until the net has reached the proper distance from the boat (Chipps Island 45.7 m; Sherwood Harbor 30.5 m). The hydraulic spools are locked in place and the boat maintains a steady trawl speed for 20 minutes. Once time has been reached, the hydraulic spools are engaged to bring the net back in. Crew members haul the net back into the boat and pile it loosely in the stern of the boat. The cod end is picked up over the transom, untied and the contents are released into one of the water filled tubs. The fish are then counted in the same way as for beach seining as described below in the fish handling section. The measured and counted fish are then placed into another tub that has flowing water for recovery prior to release.

For Kodiak trawls, a live box is attached to the cod end and the cod end is left untied. At the end of each tow, one boat maintains headway with both wings of the net attached while the other boat motors back to retrieve the live box and process the catch.

Fish Handling and Identification

The bag of the net is collected and placed into a 10 gallon (38 l) tub with water from the river or bay. The net is thoroughly checked to ensure no fish are inadvertently left behind. Every organism found is placed in the tub. Fish are retrieved from the tub with a small hand net and are placed on a measuring board for identification to species and to obtain fork length measurements (in mm). The fish are then transferred to a 5 gallon (19 l) recovery bucket prior to being released.

Thirty individuals from each species are measured. The sum of all individuals in excess of these 30 is also recorded. The endangered, threatened, or species of concern-- Chinook salmon, Delta smelt, Green sturgeon, Hardhead, Longfin smelt, River lamprey, Coho salmon and Steelhead-- 50 of each species or race of salmon are measured with the remaining enumerated. Chinook salmon with a clipped adipose fin are brought back to the office to extract the embedded coded wire tags. A coded wire tag detector wand (Northwest Technologies) is used for adipose clipped Steelhead trout to determine the presence of coded wire tags. Those with embedded coded wire tags are brought back to the office.

If there are too many fish recovered (>2000), a sub-sample may be taken from the recovery tub and placed into six sub-samples, after first ensuring that a homogenous mix has been achieved. A graduated container, with holes in the bottom to allow for water drainage, is used to collect sub-samples. Sub-samples are then placed into flow through containers which are transferred to another tub to await identification, measurement and enumeration. Once a volume has been determined, remaining fish are then released to minimize handling stress and overcrowding. Measurements, numbers of individuals and the species composition of sub-samples are then extrapolated to the population previously in the tub. This new sub-sampling protocol was implemented in 2005. In the early 1980's sub-sampling was conducted at Chipps Island using a graduated cylinder and discarding the excess water. In addition, reducing sampling times or areas have also been employed to reduce catch if too many fish are caught or the catch rate is anticipated to be high.

Physical Data Documentation

For each site sampled, a separate data sheet is used to record data. Much of the same physical data is recorded for both seines and trawls; this includes location, station code, date, time, gear code, water temperature, weather code, gear serial numbers, and names of the crew involved. For beach seines, the measurement of the area seined, the substrate code, and the conductivity readings are recorded. The volume of water sampled is determined by the product of the net length, width and depth multiplied by 0.5. For boat trawls, tow number, tow duration, tow direction, vessel used, and start and end values of the flow meter are recorded. For boat trawls, volume of water sampled is determined by subtracting the start from the end values of the flow meter and multiplied by the net size

(face area) and then multiplied by a flow meter correction factor supplied by the manufacturer (Standard Factory K Value = 0.026873). Flow meters are checked annually at the University of California Davis to ensure accuracy. The flow meters are not calibrated, but the K values for the flow meters are re-estimated. If the K values are greater or less than 10% of the standard factory K value then the flow meter is taken out of service and replaced with one that is within tolerance.

The field "condition" is used to qualify data. A condition of "1" indicates no variation from the standard procedure. Condition of "2" indicates a less than perfect set of the net or an improperly tied net. A condition of "3" indicates that a sample was taken, but the catch was impeded by a blockage in the net or the net came untied completely. A condition of "4" indicates that a sample was not taken. A "code 4" has not been entered into the database prior to the 2006 field season. In 1976, 1977, 1981 and 1984 codes 5, 6 and 7 were recorded for Chipps Island and Clarksburg trawls and some seines. A condition code of "5" indicates that other species (other than Chinook) were caught, but were not recorded. A condition code of "6" indicates that the count of individual organisms was estimated. A condition code of "7" indicates that a 100-150 ft. (30.5 - 45.7 m) seine net was used.

References to any written protocols and how to obtain a copy: The Standard Operating Procedures manual (SOP) is updated on an annual basis and is available for review at the Stockton Fish and Wildlife Office.

Changes in gear or procedures that affected the data over time: Boat trawls conducted at Sherwood Harbor change from a Kodiak trawl, which uses two boats and a larger net (12.5 m^2 face area) to a mid-water trawl, which uses one boat and a smaller net (5.1 m^2 face area) usually from April 1st to September 30th to keep in accordance with historical sampling methods and to reduce operating costs. The Kodiak trawl is more efficient in capturing the larger and less abundant salmon races and is used from October 1st through March 31st. During high water or high debris events, the mid-water trawl is used during these months instead of the Kodiak trawl for fish health and safety reasons.

Quality assurance/control (QA/QC) procedures: Since 2001, a fishery biologist has been responsible for training field personnel in the identification of fish species and implementing a QA/QC program for fish identification in the field. The QA/QC program includes testing field fish identification skills twice a year at various life history stages, reviewing preserved fish samples and accompanying field personnel in the field to assure the correct identification of the fish species collected. All personnel are trained following standard operating procedures (SOP) for field sampling during their first week of employment and then work with experienced employees for the first 3 months of their employment. The field personnel are often tested using preserved and wild specimens to insure the correct identification of fish species in various stages of their life cycles. All unknown fish species are brought back to the office for identification.

Table 8. QA/QC activity

Activity	**Primary**	**Secondary**
Fish	Printed photos, preserved fish collection, QC	Lab work and routine testing of identification

Identification	biologist, experienced field partner	skills
Data Entry	Data sheets proofed before entry, line by line proofing after entry	Spot checks, random queries, end of year proofing
Employee Training	Standard Operating Procedures, Training checklist	Experienced field partner first 3 months, formal training

Reference to any written QA/QC protocols and how to obtain a copy: Standard operating procedures and various reference sources on fish and invertebrate identification are used, including:

Cairns, Stephen D., et al. Common and Scientific Names of Aquatic Invertebrates from the United States and Canada: Cnidaria and Ctenophora. Am. Fish. Soc. Sp. Pub. 28, 2nd ed., 2002.

McLaughlin, Patsy A., et al. Common and Scientific Names of Aquatic Invertebrates from the United States and Canada: Crustaceans. Am. Fish. Soc. Sp. Pub. 31, 2005.
Miller, Daniel and Lea, Robert. Guide to the Costal Marine Fishes of California: California Fish Bulletin Number 157. Berkeley: The University of California Press, 1975.

Moyle, Peter. Inland Fishes of California. Berkeley: The University of California Press, 2002.

Nelson, Joseph, et al. Common and Scientific Names of Fishes from the United States, Canada and Mexico, Sixth Edition. Bethesda: American Fisheries Society Special Publication 29, 2004.

Turgeon, Donna, D., et al. Common and Scientific Names of Aquatic Invertebrates from the United States and Canada: Mollusks. Am. Fish. Soc. Sp. Pub. 26, 2nd ed., 1998

U.S. Fish & Wildlife Service Standard Operating Procedures, U.S. Fish & Wildlife Service, Stockton, California, 2005.

Laboratory analysis – Chemical – N/A

Laboratory analysis – Biological

Name and address of laboratory (s) running analysis: STFWO Field Office

Current since (2005):
Historical lab (if known) or reference to other documentation

Methodology for each analysis:

Current procedure since (1984)

Historical procedures (if known) or reference to other documentation: Chinook salmon and Steelhead/Rainbow trout that have been tagged with a coded wire tag are brought back to the office to have the tags removed and read. All adipose fin clipped (ad-clipped) salmon are returned to the office for tag processing, while ad-clipped Rainbow trout are checked with a Northwest Marine Technologies wand CWT detector to determine if there is the presence of a coded wire tag. The coded wire tags are read twice and any discrepancies are resolved with a third reading.

Reference used for identification of organisms: Moyle, Peter. Inland Fishes of California. Berkeley: The University of California Press, 2002.

Location of reference collection (if one exists): STFWO Field Office

Appendix